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Publisher: Routledge
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Journal of the American Institute of Planners

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rjpa19

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Published online: 18 Dec 2007.

To cite this article: Allan G. Feldt (1966) Operational Gaming in Planning Education, Journal of the American Institute of Planners, 32:1, 17-23, DOI: 10.1080/01944366608978485

To link to this article: http://dx.doi.org/10.1080/01944366608978485

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picted in a series of reports from the Hypothetical Community Training Unit, Community Services Training Section, Communicable Disease Center, Atlanta, Georgia, Bayard F. Bjornson, Chief. The vital statistics, history, and geography strongly resemble a small Georgian metropolis, but politics, race and controversy have been expunged!

[14] Norman D. Kerr, "The School Board as an Agency of Legitimation," *Sociology of Education*, XXXVIII (Fall, 1964), 34–59.

[15] Richard D. Duke, *Gaming Simulation in Urban Research*, Institute for Community Development, Michigan State University, East Lansing, Michigan, 1964.

[16] In the long run it is hoped that all-purpose simulation languages will exist which greatly reduce the programming effort and increase flexibility. But it will be some time before they have sufficient capacity for the simulation of a city. H. S. Krasnow and R. Merikallio, "The Past, Present and Future of General Simulation Languages," *Management Science*, XI (November, 1964), 236–67.

OPERATIONAL GAMING IN PLANNING EDUCATION

Allan G. Feldt

Operational gaming, a recent innovation in planning education, has shown good promise as a means of communicating knowledge and experience not easily adapted to systematic teaching, and not easily acquired by a person occupying a single position in urban affairs. The technique has shown its ability to create high motivation and retention. A general description of the Cornell Land Use Game is provided, together with an interpretation of its use by student, faculty, and professional groups. Some suggestions for further improvements of games of this nature are offered.

American urban structures have become increasingly complex and the knowledge and background information available to city and regional planners has become correspondingly great. The problems inherent in attempting to present this wealth of material to potential city planners in any coherent form within the structure of a normal planning curriculum have become almost insurmountable. A number of recent innovations in teaching such as the Skinnerian teaching machines and other types of programmed learning hold considerable promise in aiding the professional planning instructor to impart more knowledge more efficiently to more students in a shorter period of time.

Although programmed learning devices are coming into increasing use in teaching on all levels, there are some bodies of subject matter which do not form single coherent and progressive wholes and thus are not readily adaptable to presentation by these devices. Such materials, including topics of considerable importance to the student, are generally presented in the form of lectures and multitudinous assigned readings. These methods present a given body of material from many diverse viewpoints and, through continuous exposure, build up a series of insights and understandings for the student. But such knowledge is tediously and inefficiently won. To the extent that such materials will eventually be revised and rewritten in a fashion adaptable to programming, we may simply consider ourselves caught in a temporary hiatus awaiting the development of knowledge and understanding to a point where they can be more efficiently taught.

Some bodies of knowledge and experience, however, are likely never to be amenable to systematic and axiomatic presentation in the manner required of teaching machines. These are the ones that reflect more the basic understandings and insights which derive from experience in the field than the routinized facts

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and theories which can be readily gathered in a classroom context. A major part of any educational process, especially on the graduate level, consists of the development and elaboration of such insights and understandings, often in a laboratory or field problem course. I would argue, therefore, that the introduction of new methods of teaching which will speed up and enhance the development of such basic understandings and experiences among students should be assiduously sought and developed wherever practical in a professional program.

OPERATIONAL GAMING AS A TEACHING DEVICE

Heuristic teaching games have not been widely adopted in most academic disciplines, though they have been used widely in a few subject areas touching only tangentially on academic fields.[1] Their use in teaching military strategy is well known and has a history of at least several centuries. More recently a great number of games have been developed by firms and business administration schools for teaching some of the fundamentals of decision-making in a business organization. Similar uses of games in areas having close associations with the world of practical reality may be found in logistics, international diplomacy, and related topics concerned with national defense.[2]

The use of games in teaching in the more traditional academic disciplines has a much more limited and recent history. Although still not fully documented, a number of such games have been developed for the teaching of international politics,[3] animal ecology and conservation,[4] social psychology,[5] and introductory economics,[6] to name a few. The development of games representing different aspects of city planning may have a greater precedent than in most of the more traditional academic disciplines because of the similarity in subject matter orientation between planning and areas such as business, military strategy, and logistics. Notable among the planning games are Metropolis, a game representing the interactions and decision-making dilemmas of planners, politicians, and real estate speculators in a rapidly growing city (as described in the previous article in this issue);[7] POGE, a game dealing with the interactions and competing strategies of planners and real estate speculators in attempts to change zoning regulations in a previously zoned city;[8] as well as several games which appear not yet to have reached a fully operational stage of development.[9]

THE CORNELL LAND USE GAME

During the past few years a game has been developed at Cornell which provides its players with an opportunity to experience some of the more basic economic forces effecting land use decisions in the community.[10] Unlike many teaching games in which the emphasis is upon role playing behavior, this game may be more closely compared to a combination of chess and Monopoly where the players' strategies and roles are determined only in response to the rules of the game and the behavior of other players. The rules of the game, in effect, represent a rough analogue of basic economic forces which tend to shape the growth pattern of a community tempered by a few interplayer political considerations. To the extent that the rules of the game do represent actual economic "laws," the players learn how these "laws" operate in the community and how they affect political and planning decisions. This game seems especially well suited to the teaching of some of the basic principles of community growth and development; principles which are generally well known to planners and urban researchers but which usually appear in widely scattered and varied forms in publications dealing with urban geography, urban economics, urban ecology, and so forth.

The game was initially begun as a class project in an urban ecology course attempting to provide a common conceptual framework for the presentation of the many noncongruent theories and subtheories of urban land use patterns. In the game we have attempted to reduce the broad range of variables supposedly affecting urban land use decisions to a small number of basic attributes of cities and surrounding areas which appear to make up the more universal and important components of urban systems affecting these decisions.[11] Thus each individual play of the game is based upon a predetermined set of factors including the location and efficiency of a major highway network, the location of major points of access to the outside world (called ports or shipping points in the game), a particular form of real estate taxation to support the building and maintenance of various community services, and a range of land uses. These factors may be utilized by the players in their attempts to construct a viable community within which they may seek to earn a comfortable living and maximize whatever utilities seem most relevant to themselves.

Play begins with each player in possession of a fixed amount of capital with which he may seek to buy land, construct commercial or residential properties in locations of his choice, and seek to make a profit on his investments through such activities as buying and selling land, gaining employment for his residential properties, putting his industries into operation by hiring employees, or gaining customers for his commercial service establishments from among the residential units located in the community by other players.

Given the initial parameters imposed upon a particular play of the game in the form of transportation networks, taxation policies, the location of shipping points, and the kinds of land uses allowed, most land use decisions are then based upon the degree of accessibility desired between particular forms of land use already developed during the play or anticipated land use developments which seem likely to occur in future rounds of the game. Money enters the community from the outside world through payments to industries during each round of play. It is then dispersed among the other players by means of payrolls to employees and payments by households to persons operating shopping centers for routine purchases. Money leaves the community primarily in the form of payments made to defray transportation costs, through tax payments made to support community services, and through the loss of building value due to the depreciation of buildings during each round of play. Careful planning and management by the players allows them to minimize these monetary losses to themselves and the community *one,* through minimizing the distances between land uses which interact frequently, *two,* through prudent management of a community capital improvement program (to provide enough services to fulfill the needs of the growing community but not so much that services will be wasted on unoccupied land), and *three,* through careful juggling of renovation and construction costs on buildings already in operation. With careful management of their investment choices and wise decisions as to the location of investments, most players are able to realize an annual return of 10 to 20 percent on their investments. Returns of even more than 20 percent have been achieved by a very few especially prudent players and bankruptcy is a distinct possibility which has been only narrowly avoided by some.

At various times during the game, players are confronted with such decisions as whether or not to renovate their depreciated buildings or build additional roads for the community to be paid for by real estate taxes. The desirability of keeping their buildings at a moderately high level of maintenance is made relevant to the players through periodic losses of the use of buildings with probabilities which are proportional to their degree of deterioration. The construction and maintenance of roads and related community services is made necessary to the players due to the fact that new construction is not allowed on any lot not serviced by at least two roads.

EXPERIENCE WITH THE GAME

To date two to three hundred hours of playing experience with the game have been completed at Cornell. The game has been presented to a number of different groups: to undergraduate and graduate students in both informal and classroom situations, to several groups of faculty members, and to professional planners. It has even been used as a parlor game on at least two occasions. The game is presently designed for either three players or three teams of players. As many as eighteen people at once have played, with six persons on a team. It has generally been found that with more than three members per team more time is spent in trying to establish communication within the team than in actually playing the game.

Cycling time for the game usually requires about one-half hour per round, although greater or lesser amounts of time are sometimes required according to the number of economic and political decisions made by the players in any given round. It is usually possible for a group of players familiar with the game to generate a city of one to two hundred thousand population in about twenty rounds, approximately ten hours of playing time. Most novices can become fully acquainted with the basic mechanics in two to three hours of preliminary play provided they have been given an opportunity to read the descriptions of the game beforehand. Further developments which will enable at least partial use of a computer in some of its phases of operation are under way and should result in substantial reductions in playing time while allowing for the introduction of a greater number of players and a few additional refinements.

The most striking observation thus far has been the extremely high degree of involvement of the players. The game is completely engrossing. It is not at all uncommon for players scheduled to play for four hours to insist that they be allowed to continue to play for an additional four hours, often without stopping to eat. Bitter and rancorous arguments among players are commonplace, and several have reported that relationships between themselves and other players whom they have bested in some business maneuver during the game have been noticeably cooler, even outside the game context. The expected problem of getting the players sufficiently involved so as to act as though it were a real world situation does not appear to be a difficulty. On the contrary, we have found it necessary to remind the players on occasion that the whole operation is only a "game" and they should not become so upset over events in the game.

THE EFFECTIVENESS OF THE GAME IN TEACHING

No systematic attempt has been made as yet to determine the overall effectiveness of the game. The volunteered opinions of persons who have played it, however, are generally highly favorable. Many students have reported that course work in municipal finance, decision theory, zoning law, urban design, and economics as well as courses in urban ecology and geography have been much more meaningful and important to them as a result of having played it. Others have reported that they could better understand changes in urban growth patterns they had observed after having seen similar patterns of development in the course of the game. On the whole, it seems reasonable to argue that the game provides a certain amount of field experience to the participants which makes further course work in planning and related areas more significant to them. This argument is at least partially supported by the observation that those experienced in some form of professional planning activity tend to play the game better and to build a more successful community than those with little or no field experience. The superiority of experienced persons as players seems related to their ability to make rapid decisions on very complex problems with only a vague idea of all the information relevant to the decision. On the other hand, students tend to focus on one or two items of information important to the decision and to ignore the rest, while faculty members are often so busy mustering relevant information that they fail to make the decision in time to be effective.

Throughout the development of the game, we have been confronted with the problem of understanding exactly what it teaches. Everyone who has played agrees that it has taught them something about urban structure and growth though they have found it difficult to say exactly what or how the game taught them. One point which the game makes quite clear to all players, however, is the need for some form of long range planning and control in the development of a community. Players are repeatedly confronted with the undesirable effects of investment and land use decisions which seemed perfectly rational when they were made in earlier rounds. Thus, prime industrial land is often found to be cluttered up with fairly expensive residential uses in later rounds when useable industrial land becomes quite scarce. Considerable costs to the community as a whole are often incurred in the construction and maintenance of roads which are not needed at the present moment and sometimes are never brought fully into use. Shopping districts are often found to be very costly in terms of transportation, when a little foresight would have provided more centralized locations with less overlap of similar and competing services. These and a number of related insights provide the players with an understanding on an abstract level of the need for greater planning and coordination of activities in order to minimize the amount of confusion and expense incurred by inappropriate land uses and developments in later stages of the game.

Thus the game certainly teaches some of the ways in which planning and controls can be used in guiding the course of community development, far beyond teaching the aspects of urban ecology that were our original interest. Further, it teaches the ways in which plans can impede growth when they tend to be too restrictive. The players themselves create the problems in land use control and development which they—as planners—are faced with trying to solve.

FURTHER MODIFICATIONS OF THE GAME

At this point, the Cornell Land Use Game has reached the stage where it is fully operational and may be developed and tested further in the classroom. It is currently being used on at least a limited scale in several planning-related courses in a few universities. Further experience and modification of the game in such a setting seems likely to provide an important addition to the learning experience of students in planning and other fields dealing with urban theory. At Cornell, the basic innovation being attempted is to utilize the present general organizational structure to allow the students to grow a community to a fairly advanced stage of development. At several stages play will be stopped and students will be asked to provide planning services for the community before them. Population and land use projections will be sought; histories of past growth and capital improvement programs for the future will be required; the possibility of imposing or modifying some form of land use control such as zoning will be encouraged; and provisions for setting aside some land for parks, schools, industrial development, and future highway expansion will be introduced. Basically, the students will be asked to prepare an analysis of their community and to provide a ten- or twenty-year plan for its future development. Following the presentation and criticism of their plans and administrative innovations, the students will return to playing the game and they will, in effect, grow the community through another ten years of development, possibly destroying their own plans in the process.

A series of interpositions of the planning functions followed by economic growth activities seems very likely to provide students with a sensitivity and experience in a short time which would be available only through several years of field experience without the use of heuristic gaming. The community presently being grown by the game will bear a close resemblance to Syracuse and its environs, which is the same community to be used by the students in the planning field problem. The basic topographic features and transportation networks of the Syracuse area have been imposed upon the game and play begins with the approximate land use patterns of that area in 1960.

An observation made by most persons who have participated in the game is its high degree of complexity coupled with a recognition that it represents a picture of reality stripped of all but the barest essentials. Most players complete the game with a desire to introduce additional innovations which will make it more detailed, more realistic, or more exciting. Many of these probably would be of great utility in further development. The introduction of such modifications is very tempting, but the costs of disrupting the rather finely balanced internal mechanics of the game are often prohibitive. Even a slight modification of a seemingly unimportant rule has often been found to create changes in operation and structure which require months to correct and rebalance.

In addition to modifications in progress to represent the Syracuse area, a few other possibilities have been suggested which appear well worth the effort required to reconstruct the game for their incorporation.[12] Some of these contemplated modifications include: *one,* the introduction of a variable market for industrial goods which would result in occasional plant shutdowns; *two,* the accumulation of inventories of manufactured goods, and competition among industrial players for sales in a depressed market—much in the manner of some of the presently existing business management games; *three,* the introduction of a financial player who, with a limited amount of capital, will provide loans, mortgages, and other forms of financial assistance to the players in the game; *four,* the introduction of zoning possibilities together with a zoning board of appeals and a few related governmental functions; and *five,* the linking of this game with one or more other games already in existence.

Consideration is being given to the possibility of combining the operations of the Cornell Land Use Game with those of the Michigan State game, Metropolis. The combination of the two appears relatively straightforward since they tend to complement rather than conflict with each other. In such a combination the topographic and transportation factors in the Cornell Land Use Game would be modified to fit the factors affecting land use patterns in the city represented in Metropolis, while the planning and political decisions generated by the players in Metropolis would probably be changed so as to be suitable for imposition upon the players in the Cornell Game.

CONCLUSION

At this point, the development of heuristic games in planning is still in its early developmental stages. Many innovations and modifications must still be introduced to make the games more realistic and of greater utility to the planning student and the professional planner. The value of games such as these for planning education and for teaching basic principles of community organization seems clear, however, and further developments in heuristic gaming of urban problems seem likely to occur both in universities and among professional planning staffs.[13] Due to the considerable investment in time and money which the development of such games requires, it is to be hoped that full cooperation and exchange of information will continue to characterize the development.

The Cornell Land Use Game described here is only one of many possible in this field and it has been severely restricted in its elaboration because it was developed without access to computerized bookkeeping facilities. This game can be criticized for its very limited scope and its emphasis upon a few aspects of transportation costs and taxation problems. It should also be made clear that its level of detail in representing land use patterns is very low and that it tends to function most adequately in its present form on a metropolitan scale rather than on the scale of the city itself. Nonetheless, the technique of gaming seems to be well illustrated by this and other examples, and it is the techniques rather than any particular game which appear to hold considerable promise for further developments in planning education.

A final caveat must be entered regarding the relationship of operational gaming to other forms of simulation better known to most planners. The intent of most of the highly sophisticated computer simulation models in use in planning today tends to be quite different than the purpose of most operational gaming models. Operational games are highly effective teaching and communication devices but their utility for prediction and replication tends to be low. Even when an operational game is constructed on the basic characteristics of some existing city, there is not much likelihood that the game will faithfully replicate the growth of that city either historically or in the future. It does not seem likely that their utility as predictive devices will be increased until they are linked with highly detailed and sophisticated mathematical models.

At this point, my opinion is that operational games should be developed primarily as teaching and communication devices. Their usefulness in this area has been well demonstrated. With some additional experience and development these forms of representation may be effectively used as laboratory experimental models as well, testing the gross effect of some strategic change in policy, law, transportation facilities, or other parameters.

NOTES

[1] For an excellent coverage of the history of games in military and business management applications together with a review of their major strengths and weaknesses see Kalman J. Cohen and Eric Rhenman, "The Role of Management Games in Education and Research," *Management Science,* VII (1961), 131–166.

[2] A good coverage of the relationships between games and other forms of simulation and model building as they have been developed in national defense planning is given in M. A. Geisler, W. W. Haythorn, and W. A. Steger, "Simulation and the Logistics Systems Laboratory," *Naval Research Logistics Quarterly,* X (March, 1963), 23–54.

[3] Harold Guetzkow, *Simulation in International Relations: Developments for Research and Teaching* (Englewood Cliffs, N. J.: Prentice-Hall, 1963). The game whose operation and development is described here is now being used at several universities in conjunction with undergraduate courses on international politics.

[4] Richard Meier, "Simulation of Ecological Relationships," *Behavioral Science,* IX (January, 1964), 67–80.

[5] William Gamson, Professor of Sociology, University of Michigan, Ann Arbor.

[6] Herbert Fraser, Professor of Economics, Washington University, St. Louis.

[7] Richard D. Duke, *Gaming Simulation in*

Urban Research (East Lansing, Mich.: Institute for Community Development, Michigan State University, 1964). In addition to a description of Metropolis, this monograph also provides a good history of the uses of games in several fields and an extensive bibliography on gaming techniques.

[8] Francis H. Hendricks, "Planning Operational Gaming Experiment," a paper prepared for the Northern California Chapter American Institute of Planners' Professional Meeting on "New Ideas in Planning," November 19, 1960.

[9] Nathan Grundstein, "Computer Simulation of a Community for Gaming," a paper presented at the Denver meeting of the AAAS, 1961. (Mimeographed) See also Robert F. Edwards and Dorothy E. Francis, "Intercity Competition, The Community Growth Game," *General Systems,* VIII (1963), 183–208.

[10] For a more complete description of this game in terms of its basic components and rules of play see Allan G. Feldt, "The Cornell Land Use Game," Miscellaneous Papers No. 3, Center for Housing and Environmental Studies, Division of Urban Studies, Cornell University, New York.

[11] The word "we" is used here in more than an editorial sense since many persons have assisted and advised in the development of the game. Particular acknowledgement should be given to Burnham Kelly for financial and moral support, to Richard Meier for my initial introduction to operational gaming, to many of my colleagues and students at Cornell who played in earlier versions of the game and to those students who participated in the critical developmental innovations of the game: Phillip Peters, Melvin Ginsburg, Ramon Bescos-Dominguez, Richard Smith, William Goldsmith, and David Povey.

[12] Some of these modifications have been suggested and explored by George Duggar and Edward Foster at the Institute for Public and International Affairs, University of Pittsburgh, where derivatives of the Cornell Land Use Game have been adapted for use in several courses.

[13] An interesting and provocative proposal for the possible use of such a game by a professional planning staff may be found in Alvin H. Lewis and Dr. Lee Purlee, "Toward the Advancement of Comprehensive Planning Technique," (Lexington, Kentucky: Spindletop Research, Inc.) (Mimeographed.)

FEAR AND THE HOUSE-AS-HAVEN IN THE LOWER CLASS

Lee Rainwater

The focus of interests and goals in relation to housing vary by social status even within the large group of families called working class. The most disadvantaged groups are concerned with shelter per se; traditional working class families with opportunities to elaborate their dwellings in personally expressive ways; and the more prosperous modern working class with buying the "standard all-American package." The lower class seeks shelter from a wide variety of human and nonhuman threats, from which they fear consequences that combine elements of physical threat, disruption of familial and other interpersonal relations, and threats of moral damage to the self. This bears implications for the design of public housing.

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Men live in a world which presents them with many threats to their security as well as with opportunities for gratification of their needs. The cultures that men create represent ways of adapting to these threats to security as well as maximizing the opportunities for certain kinds of gratifications. Housing as an element of material culture has as its prime purpose the provision of shelter, which is protection from potentially damaging or unpleasant trauma or other stimuli. The most primitive level of evaluation of housing, therefore, has to do with the question of how adequately it shelters the individuals who abide in it from threats in their environment. Because the house is a refuge from noxious elements in the outside world, it serves people as a locale where they can regroup their energies for interaction with that outside world. There is in our culture a long history of the devel-